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(54) Improved telecommunication system through mains electricity conductors

(57) A line communication system for linking a plurality of telephone subscribers to a public telephone exchange, wherein the subscribers are each located within the same general area, and wherein each subscriber is fed from the same mains electricity sub-station with mains electricity, comprises subscriber apparatus which includes a cordless telephone (CT) handset and a frequency convertor, one for each subscriber, the handset being hard wired to the mains electricity supply conductors via the frequency convertor so that CT signals at UHF are down-converted to HF for transmission through the mains electricity conductors, and a CT base station connected to the public telephone exchange, which CT base station is connected to the mains electricity supply conductors via a further frequency convertor for HF line communication purposes, a control matrix being provided in operative association with the said base station, which serves to associate an address (corresponding to a telephone number) for each subscriber as recognised by the public telephone exchange with corresponding channels assigned by the CT protocol to each subscriber whereby the public telephone exchange and the subscribers are placed in mutual two-way communication and that calls are correctly routed and billed.

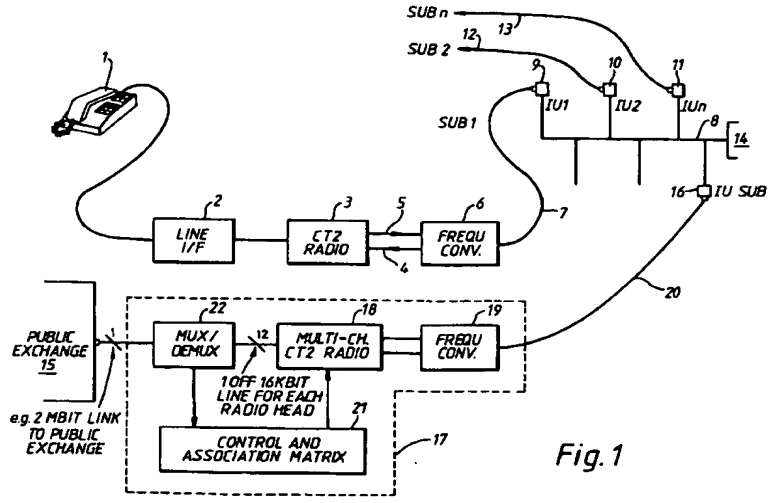

Fig. 1

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Description

This invention relates to line communication systems and more particularly it relates to such systems which utilise mains electricity conductors to carry signals for communication purposes.

According to one aspect of the present invention a line communication system for linking a plurality of telephone subscribers to a public telephone exchange, wherein the subscribers are each located within the same general area, and wherein each subscriber is fed from the same mains electricity sub-station with mains electricity, comprises subscriber apparatus which includes a cordless telephone (CT) handset and a frequency convertor, one for each subscriber, the handset being hard wired to the mains electricity supply conductors via the frequency convertor so that CT signals at UHF are down-converted to HF for transmission through the mains electricity conductors, and a CT base station connected to the public telephone exchange, which CT base station is connected to the mains electricity supply conductors via a further frequency convertor for HF line communication purposes, a control matrix being provided in operative association with the said base station, which serves to associate an address (corresponding to a telephone number) for each subscriber as recognised by the public telephone exchange with corresponding channels assigned by the CT protocol to each subscriber whereby the public telephone exchange and the subscribers are placed in mutual two-way communication.

By utilising a CT handset for each subscriber, and a CT base station which is located remotely therefrom to serve them, a system is provided in which a considerable saving of dedicated telephone lines is effected together with a reduction in complexity of the public telephone exchange switching facilities. This latter feature is afforded by reason of the fact that a part of the switch function which would otherwise be provided at the public telephone exchange is provided by the CT base station, and because all subscribers served by a base station will not statistically require line usage at the same time, further economies may be effected. For example, a base station serving 150 domestic subscribers may require only 12 telephone exchange lines in order to provide a good grade of service.

The frequency convertors used in the subscriber apparatus and in the base station may be similar.

In a system according to said one aspect of the invention, by using frequency convertors for each CT handset and the CT base station, an existing CT handset design such as a CT2 handset, can be used without modification in combination with a corresponding CT2 base station, however, in accordance with an alternative aspect of the invention, it may be arranged that the telephone signals are outputted directly at HF.

According to this alternative aspect of the invention, a line communication system for linking a plurality of telephone subscribers to a public telephone exchange, wherein the subscribers are each located within the same general area, and wherein each subscriber is fed from the same mains electricity sub-station with mains electricity, comprises subscriber apparatus which includes a modified CT handset adapted to provide output signals at HF, one such modified handset being provided for each subscriber, the handsets being hard wired to the mains electricity supply conductors so that CT signals are transmittable through the mains electricity conductors, and a modified CT base station connected to the public telephone exchange, which modified CT base station is connected also to the mains electricity supply conductors so as to receive HF signals transmitted from the subscribers, a control matrix being provided in operative association with the said base station, which serves to associate an address (corresponding to a telephone number) for each subscriber as recognised by the public telephone exchange with corresponding channels assigned by CT protocol to each subscriber, whereby the public telephone exchange and the subscribers are placed in mutual two-way communication and that calls are correctly routed and billed.

A CT handset or base station used in accordance with either of the foregoing aspects of the invention may advantageously correspond to a cordless telephone standard (or selected parts thereof) such as the Common Air Interface (CAI) standard as specified by the European Telecommunications Standards Institute (ETSI) and known as CT2, or the Digital European Cordless Telecommunications (DECT) standard as also specified by ETSI. For data or broadband applications, the standard channel usage is abandoned in favour of a more efficient filling format which requires less 'overhead' per channel and releases pay-load bits (by employing a common overhead for a group of concatenated channels forming the broadband bearer).

Conveniently, the modified CT base station may be installed at an electricity sub-station located remotely from the subscribers.

Alternatively, however, the CT base station may be located in close proximity to one of the subscribers.

Using existing CT protocols there is a limit to the number of subscribers which can be served from each base station, the number being determined in accordance with the particular cordless telephone protocol used, e.g. CT2 or DECT. However, by using a plurality of different HF frequency bands, one band for each of a plurality of different subscriber groups, the number of subscribers served can be substantially increased.

Thus, a plurality of base stations may be used, each serving a different group of subscribers and each base station being arranged to use a different HF frequency band, whereby contemporaneous use of the same electricity supply conductors is facilitated.

Although systems according to the present invention are eminently suited for telephone voice communication, it is envisaged that the systems may be used for data transmission which may include video systems, fax systems or data communication systems for in-home entertainment, for example.

One embodiment of the invention will now be described by way of example only with reference to the accompanying drawings, in which;

FIGURE 1 is a block schematic diagram of a line communication system;
FIGURE 2 is a block schematic diagram of a MUX/DEMUX and 8 MHz CT2 interface which forms a part of the system shown in Figure 1;
FIGURE 3 is a block schematic/flow diagram illustrative of the functionality of a control and association matrix which forms a part of the system shown in Figure 1, and,
FIGURE 4 is a block schematic diagram including a frequency convertor which forms a part of the system shown in Figure 1.

Referring now to Figure 1, a line communication system comprises a subscriber's telephone handset 1, which is coupled via a line interface unit 2 to a CT2 radio unit 3. Input signals to the CT2 radio unit 3 on a line 4 and output signals from the CT2 radio unit 3 on a line 5, which would normally be radiated through the ether at UHF in the CT2 radio frequency operating band (which lies between 862 MHz to 866 MHz), are fed to a frequency convertor 6. The frequency convertor 6 serves to convert the CT2 frequency band so that it is centred on 8 MHz (i.e. the 4 MHz CT2 bandwidth lies between 10 MHz and 6 MHz). Although an 8 MHz centre frequency has been selected in the present example, it will be apparent that other centre frequencies in the HF band would serve satisfactorily for the same purpose. Line communication signals are fed from the frequency convertor 6 via a line 7 to the conductors 8 of a mains electricity supply network via an interface unit 9, which includes isolating components by means of which the telephone apparatus including the frequency convertor 6, are isolated from the mains electricity supply voltage. Similar interface units 10 and 11 are shown which communicate via lines 12 and 13 respectively with other subscribers. The interface units 9, 10 and 11 are fed with mains electricity from a substation 14.

In order to provide a telephone communication link between the subscriber telephone handset 1 and another subscriber via a public telephone exchange 15, the public exchange is linked to the mains electricity supply via an interface unit 16 and a base station as shown within broken line 17. The base station as shown within the broken line 17 includes a multichannel CT2 radio base station 18 which is fed from the interface unit 16 via a frequency convertor 19. The frequency convertor 19 serves to convert HF signals transmitted from telephone subscribers via the electricity supply conductors 8 and the interface unit 16 on a line 20 to UHF signals which are applied to the CT2 radio base station 18. The radio channel for a given link is selected automatically by the CT2 protocol and in order to associate subscribers identified by the CT2 radio protocol with telephone lines as recognised by the public exchange 15, a control and association matrix 21 is provided which includes a look-up table for facilitating the necessary association between the CT2 designation and public exchange addresses (telephone numbers).

The frequency convertor 6 and the frequency convertor 19 may both be fabricated using any well established frequency changing technique but one frequency convertor suitable for performing a frequency conversion operation as performed by the frequency convertor 6 will now be described with reference to Figure 4.

Referring now to Figure 4, wherein the lines 4, 5 and 20 shown also in Figure 1 are included, the frequency convertor 6 comprises a synthesiser 22, which operates at 874.1 MHz and which is arranged to feed a pair of mixers 23 and 24 via an amplifier 25 and a signal splitter 26. The mixer 23 is fed also via the line 5 from the CT2 radio unit 3 with transmitted signals in the CT2 UHF band, thereby to produce HF output signals from the mixer 23 which are fed via a 6-10 MHz band pass filter 27 and an amplifier 28 to the line 20 via a TX/RX switch 29. The mixer 24 on the other hand is fed also via a 6-10 MHz band pass filter 30 and an amplifier 31, with HF signals from the switch 29 when it is appropriately set, thereby to produce UHF signals which are fed to the CT2 radio 3 on the line 4 via a UHF band pass filter 32. Control of the contacts of the TX/RX switch 29 is effected via a line 33 in accordance with whether a transmit or receive function obtains within the CT2 radio unit 3. It will be appreciated that the frequency convertor 19 operates in substantially the same manner as hereinbefore described with reference to the frequency convertor 6 to produce a similar result, and may therefore comprise substantially identical circuitry.

In order to facilitate a better understanding of the manner of operation of the system, the MUX/DEMUX and 8 MHZ CT2 interface unit 22 is shown in detail in Figure 2 and the control and association matrix 21 is shown in detail in Figure 3. These are required to ensure that incoming calls from the PSTN are routed to the correct subscriber and that the correct subscriber is billed for each outgoing call. The operation and construction of these arrangements will be fully appreciated from the drawings by those skilled in the art and further explanation of their functionality is therefore believed to be unnecessary.

It will be readily appreciated that using CT2 protocol, for example, the CT2 radio base station unit 18 can serve up to 150 domestic subscribers, and since all subscribers are not likely to be using the system at any one time, 150 public telephone exchange lines need not be provided by the public exchange switch network 15. In fact, in order to provide a reasonable service, as few as 12 to 15 lines may be all that is required in order to facilitate the provision of a reasonable service level.

If the electricity sub-station 14 were arranged to feed electricity to a large number of consumers, it may be required to provide telephone services for more than 150 domestic units which could be the limit of a single CT2 base station unit. In order to satisfy this requirement,

however, it would be possible to operate two or more base stations in parallel, each of which would be arranged to use a different HF frequency band, and so if say three different HF frequency bands were used, up to 450 telephone subscribers may be served via the electricity supply conductors associated with a common electricity sub-station.

It will be apparent that various modifications may be made to the arrangements hereinbefore described without departing from the scope of the invention and for example any other protocol may be used, which may or may not be a CT protocol and which may be adapted to provide services additional to voice communication services, such as data services as may be required for video systems for example.

Claims

1. A line communication system for linking a plurality of telephone subscribers to a public telephone exchange, wherein the subscribers are each located within the same general area, and wherein each subscriber is fed from the same mains electricity sub-station with mains electricity, comprises subscriber apparatus which includes a cordless telephone (CT) handset and a frequency convertor, one for each subscriber, the handset being hard wired to the mains electricity supply conductors via the frequency convertor so that CT signals at UHF are down-converted to HF for transmission through the mains electricity conductors, and a CT base station connected to the public telephone exchange, which CT base station is connected to the mains electricity supply conductors via a further frequency convertor for HF line communication purposes, a control matrix being provided in operative association with the said base station, which serves to associate an address (corresponding to a telephone number) for each subscriber as recognised by the public telephone exchange with corresponding channels assigned by the CT protocol to each subscriber whereby the public telephone exchange and the subscribers are placed in mutual two-way communication and that calls are correctly routed and billed.

2. A line communication system as claimed in Claim 1, wherein the frequency convertors used in the subscriber apparatus and in the base station are similar.

3. A line communication system as claimed in any preceding claim, wherein the CT handset and CT base station correspond to the Common Air Interface cordless telephone standard as specified by the European Telecommunications Standards Institute (ETSI) and known as CT2.

4. A line communication system as claimed in any of Claims 1 to 2, wherein the CT handset and CT base station correspond to the Digital European Cordless Telephone (DECT) standard as specified by ETSI.

5. A line communication system as claimed in any preceding claim, wherein the CT base station is installed at an electricity sub-station located remotely from the subscribers.

6. A line communication system as claimed in any of claims 1 to 4, wherein the CT base station is located in close proximity to one of the subscribers.

7. A line communication system as claimed in any preceding claim, wherein a plurality of different HF frequency bands are used, one band for each of a plurality of different subscriber groups.

8. A line communication system as claimed in Claim 7, wherein a plurality of base stations are used, each serving a different group of subscribers and each base station being arranged to use a different HF frequency band.

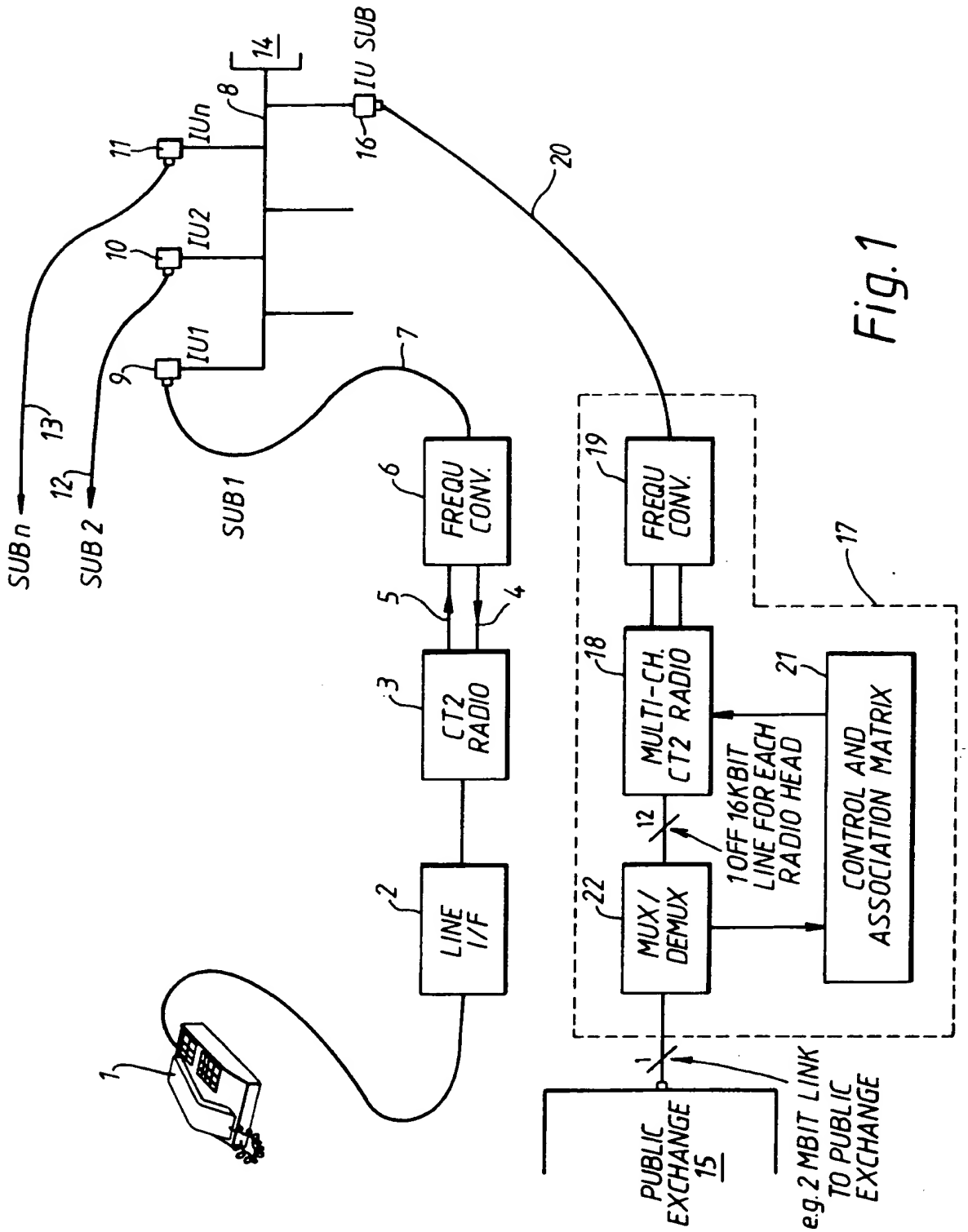

Fig. 1

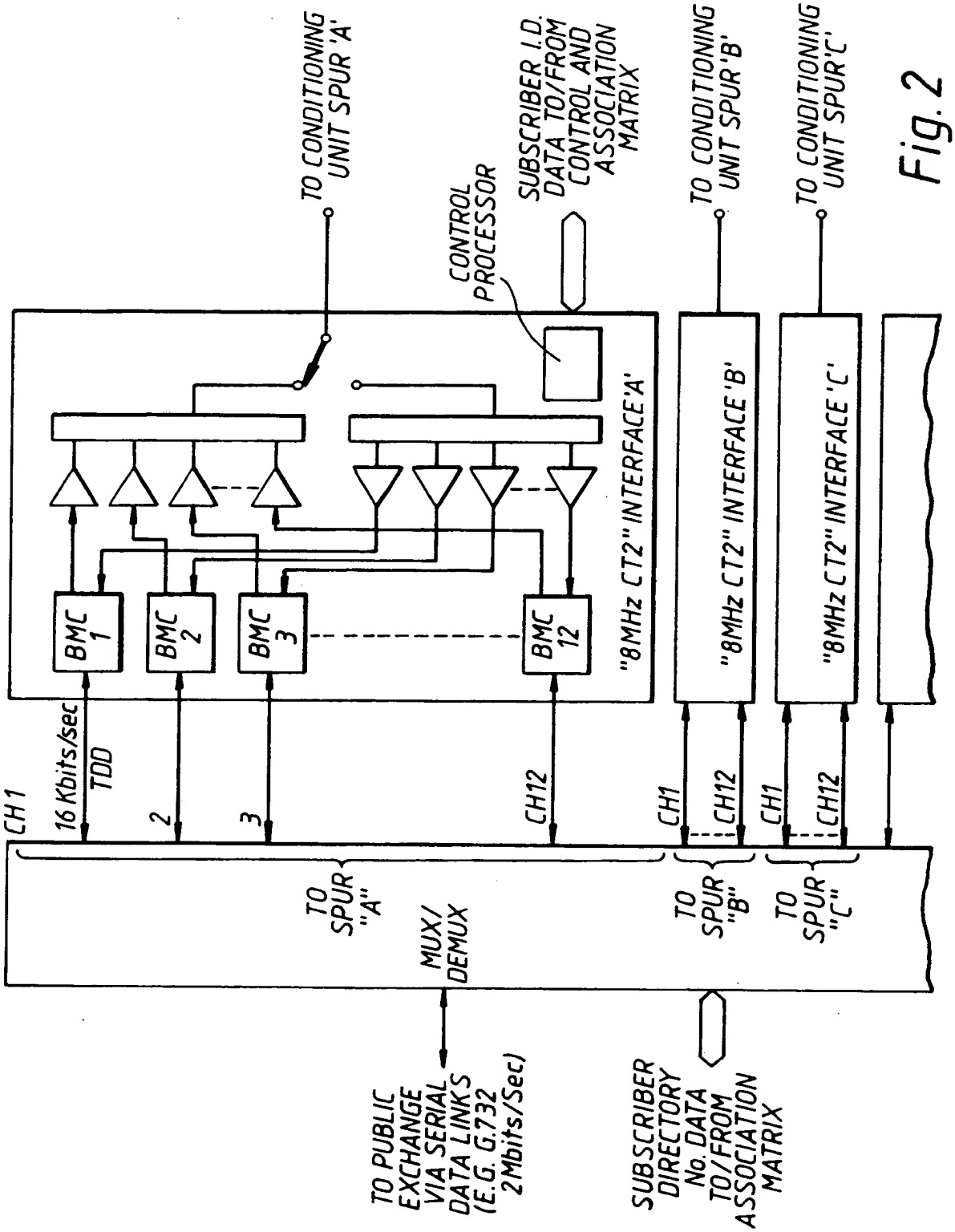

Fig. 2

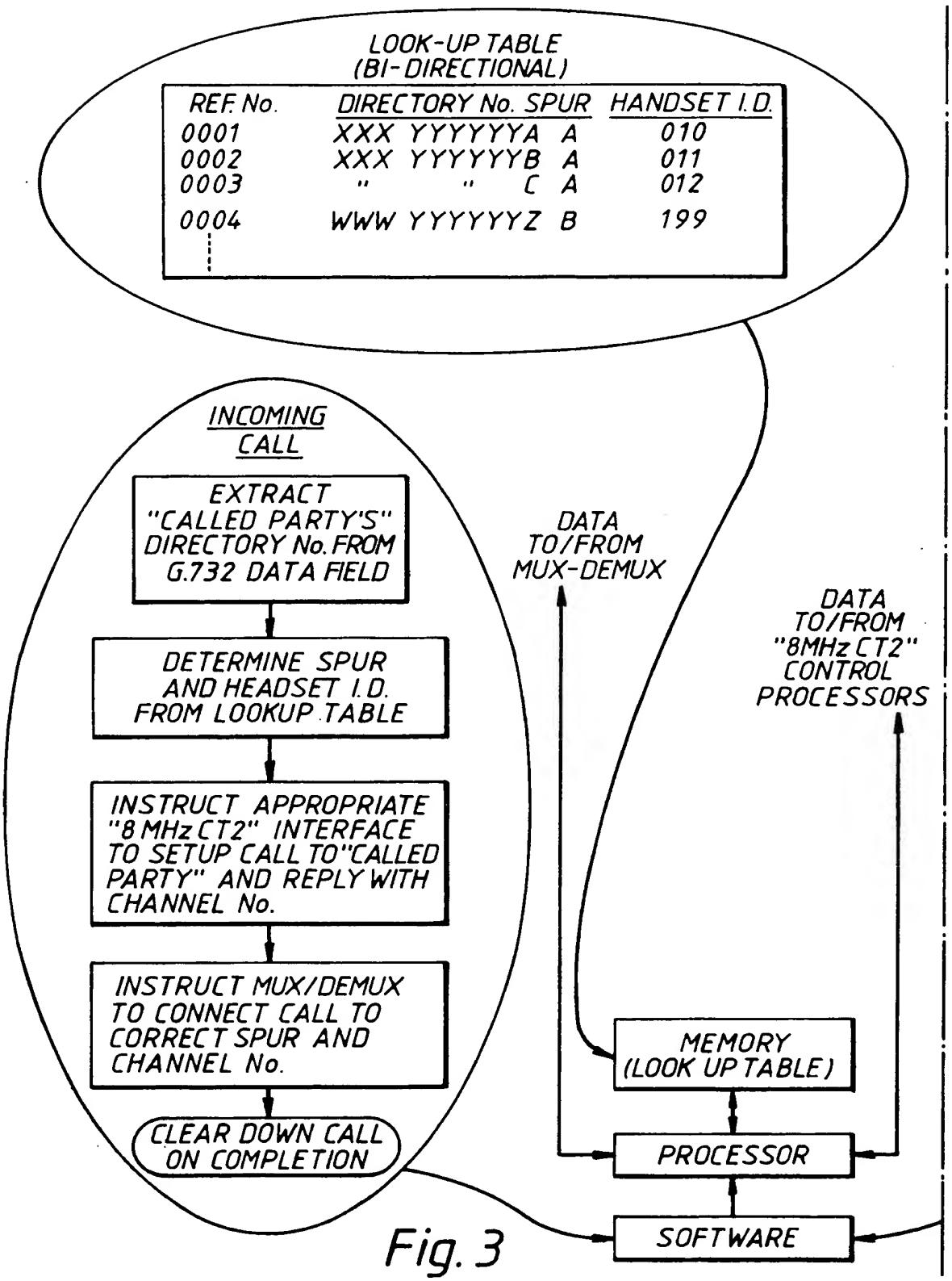

Fig. 3

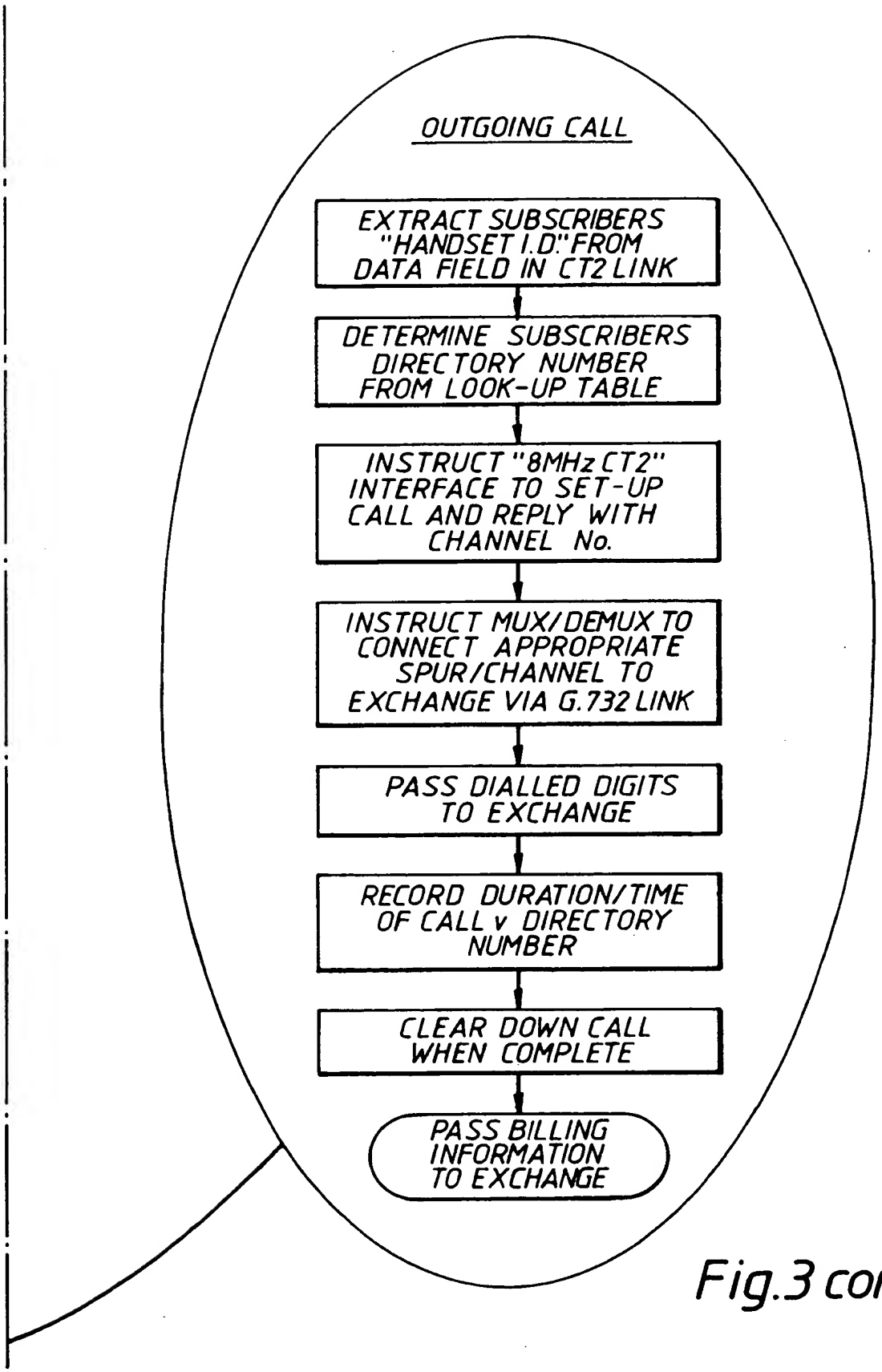

Fig.3 cont.

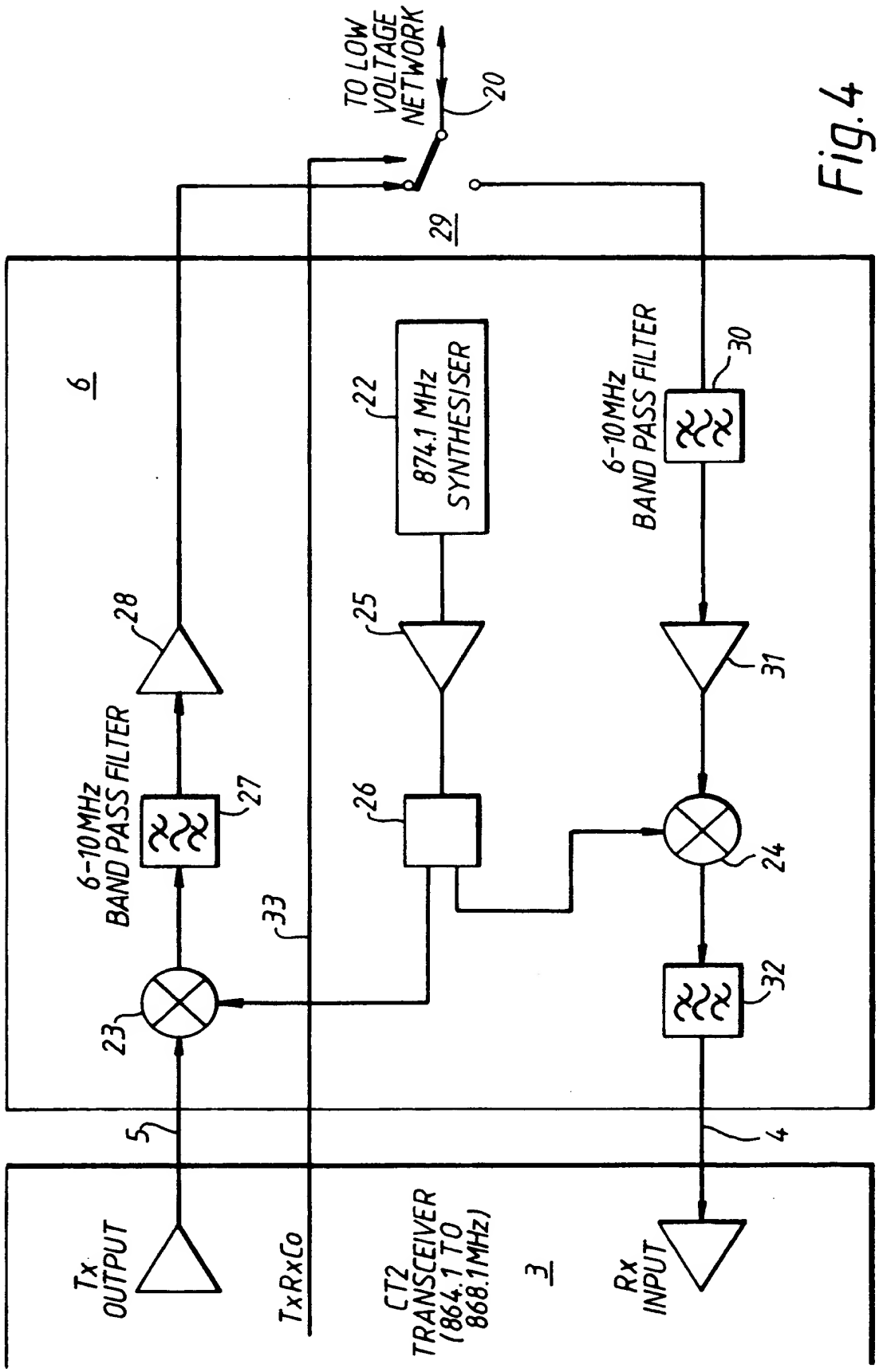

Fig.4